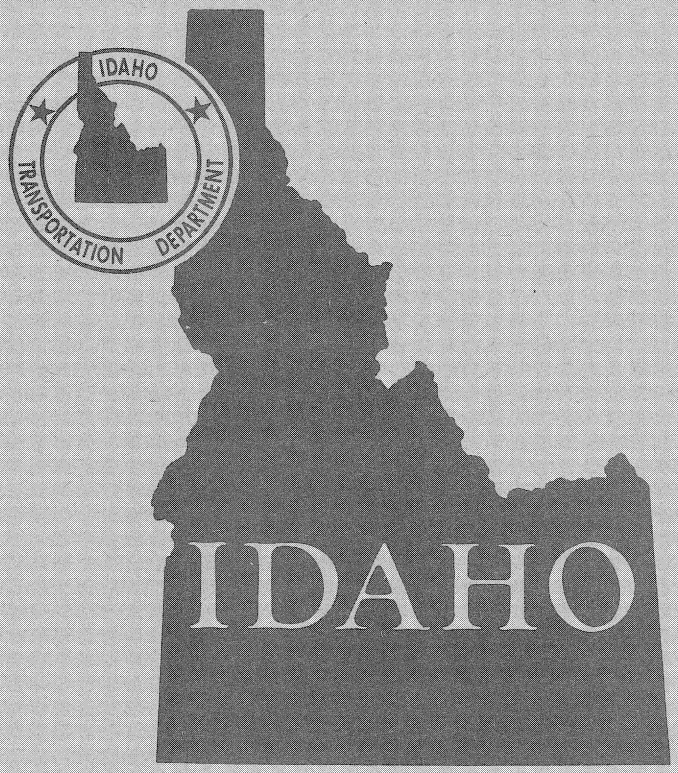
TRANSPORTATION DEPARTMENT



RESEARCH SECTION

F I N A L R E P O R T

POLYMER CONCRETE BRIDGE DECK OVERLAY NEAR MURTAUGH, IDAHO

Prepared for FHWA Implementation
Division, Office of Development
Requisition No. 42-22-8209

Idaho Transportation Department
Research Section
Research Project 96

August 1982

Typist Pat Marler

ABSTRACT

This final report covers the evaluation and construction of a Polymer Concrete Bridge Deck Overlay. The users manual (FHWA RD-75-501) provided by Oregon gives information complete enough to design and estimate the work required for a type "A" and "B" deck treatment.

Standard bridge deck finishing equipment equipped with heavy vibrators is capable of finishing and compacting polymer concrete overlays.

Mixing equipment is not developed to handle the polymer materials. Mortar mixers having less than a yard capacity can handle the mixing. The Daffin mobil mixer mixes the material well but the liquid set time versus the mix set time problem has not been solved.

The polymer materials are not performing as desired. The bonding to the deck is not adequate. Environmental changes are causing the damage.

The Type "B" treatment did not provide a waterproof layer. Laboratory tests of the two layer system show water penetrates the system.

Acknowledgment

Technical assistance was received from Ralph W. Coho, Jr. and Bob Buckwaller of Daffin Mobile Mixer, and Barber Greene, Murray Rowe of Bidwell, C.M.I. Without this support, the project could not have been a success.

Bill Quinn, Research Engineer of Oregon provided the technical assistance necessary to keep the project on tract.

John Barthelomew and Anthony Lizzio of FHWA Office of Development provided technical support and supplied the finishing machine for the second year.

A special thanks to Howard Johnson, District Engineer for supplying the bridge deck and the very hard working crews to complete the job. Bill Garrett, District Bridge Inspector earned special mention.

Introduction

The premature deterioration of reinforced concrete bridge decks has caused billions of dollars of damage and is causing additional hazards to the traveling public. The increased use of deicing salts and subsequent corrosion of the reinforcing steel has led to research and development work into curative measures to halt deterioration of decks. Oregon DOT (1) has developed a polymer concrete overlay that shows promise by, 1) acting as a barrier to chloride penetration, and 2) providing a reasonable wearing surface.

Idaho's project was to evaluate this overlay process using a bridge deck finishing machine available to local contractors. Other mechanization of the operation was attempted.

Adaption of the mixing equipment was necessary but batching, placing, and finishing equipment was standard non-modified equipment.

Change orders during the project included a State of the Art Conference in Oregon and Type B treatment using polymer material.

Summary and Conclusions

The finishing equipment, both Bidwell and Gomaco is capable of leveling, finishing, and compacting the polymer material. Cold joints and starting are problems because of the harshness and fast-setting of the materials. If a continuous supply of mixed material is possible, the finishing machine is capable of strike off compaction and finishing this material to a preset grade. The finish and compaction of the material are very satisfactory when a heavy duty finishing machine is used.

The Type B overlay, although a change order item, appeared very successful. Laboratory testing was conducted and the Type B overlay was found to be ineffective.

Recommendations

The resin materials used on this project had to be initiated and promoted in the field. This required a chemist as a full time member of the field crew. The measurement and mixing of these ingredients was time and effort

consuming. It would be much better to buy promoted resin and have to add only the initiator in the field.

The Oregon overlay procedure in FHWA RD-75-501 was followed. The potlife of initiated materials (liquid) is only ten minutes, while the mixture has a two hour set time. This does not allow for any mixing or finishing delays once the resin is initiated. Delays at joints, offsets, beginning, or ends are very common. If the crew is capable of finishing all the work in a continuous operation. Polymer materials may work.

The Daffin Mobile Mixer Company was very cooperative in furnishing resin handling equipment. The pumps and controls were capable of doing the work but the fast setting of the resin gave us problems. Resin initiation was the only problem that has not been solved. With the time and money available, we were unable to get this answer. Ideas that should be pursued are initiaion of the resin just as it is pumped into the mixer or addition of the initiator to the dry aggregate so again initiation is started in the mixer.

Background

A two-lane structure was chosen, located on U. S. 30 at milepost 238.2. It is 28 feet wide, 141 feet long, and has an ADT of about 1,000. The bridge deck is subject to occasional applicatons of deicing salt.

A copy of the half-cell results is Appendix B. Six chloride tests were made, and a copy of the results are in Appendix B. No patching was needed.

Dry bagged aggregate meeting the gradation recommended by Oregon was the first supply problem. Local sources did not have the same materials, so multibag blends were necessary. Before bagging the material, tests were run for gradation control and a three-bag blend was necessary to meet the proposed gradation. This material was ordered and used the first year. Because of the problems in blending, a new gradation with 1/2" maximum size aggregate was used the second and third years. These worked much better for the aggregates available in Idaho. A copy of the specifications and test results are in Appendix B.

The polymer materials were ordered and no substitutions were made. The shelf life of the materials was questioned, but after three years operations with the materials, they preformed well. A list of materials purchased and used are in Appendix B.

Construction 1978

State maintenance personnel were used as the major labor for this project, so it was scheduled near the end of the summer busy season. It was anticipated the project would require about one week to complete.

Equipment for was rented from Miller Construction Company and consisted of a Bidwell heavy duty deck machine, the rail and chairs for this machine, a Daffin Mobil Mixer and a crane to place the finishing machine on the deck.

Two gear pumps for the resin were furnished by the manufacturer of the Daffin mixer. These were driven by electric motors for this operation. The pumps were of equal capacity, so a 1:1 resin formulation was used, with one part containing the promoters and the other part containing the initiator and inhibitor. The pumps were constant displacement with a bypass valve to control the flow.

The resin was pumped directly from the shipping drums. The resin delivery lines were plumbed into the water and latex lines on the Daffin mixer close to the mixing auger. A pipe Y was attached to the outlets of the two lines and connected to an improvised static blender consisting of a piece of pipe with several bolts inserted transversely across the bore.

Two days were needed to calibrate the resin pumps and aggregate feed on the Daffin mixer. Calibration method used was the same for any continuous operation, a time vs weight check. The variable on the resin pumps was the bypass amount. The variable on the aggregate feed was the gate setting. During this time, the Bidwell low-slump finishing machine was adjusted and checked.

On Wednesday, all equipment was moved to the bridge for the first placement. The mixer and the truck carrying the resin and pumps were operated side by side on the deck, allowing direct placement. The two trucks moved intermittently along the deck as placement proceeded. One resin pump motor was overheating badly and one pump was leaking slightly. About ten feet of deck had been covered in one lane, when the overheating pump motor began smoking heavily and placement was stopped.

After about two hours, the polymer concrete was removed from the deck because it hadn't set. Removal was needed to allow traffic to use the deck overnight. The retarded set was a result of using only one per cent initiator with ambient temperature of about 65 F. This was done to allow extra finishing time, but the effect on set time was underestimated.

The next day a 1 1/2 hp motor was brought to the site to replace the 1 hp motor which had been smoking. Polymer concrete placement was begun about lunchtime, with ambient temperature about 65 F. Initiator content was two percent. A distance of about 30 feet was covered in one lane. Placement was interrupted once or twice by overheating of the pump motors. Chain dragging indicated good bond of the material placed during this run.

Because of the pump motor problems, an electrician was called out to check the generators and motors. He found the 1 hp motor was running more than 50% overloaded and the 1-1/2 hp motor was about 10% overloaded.

The morning of Friday, October 20, a 2 hp motor was installed on each of the resin pumps. Placement began again

about lunchtime, using two percent initiator. Both resin pumps were leaking. A distance of about 40 feet was placed. The operation was stopped when the resin containing initiator set up in the pump. We believe this was caused by overheating of the material as it circulated through the pressure-control bypass loop on the pump.

About 1/4 of the total overlay area was placed during the week. Because of the resin pump problems and the imminent onset of cooler autumn weather, field operations were suspended for the season.

The concept of using the Daffin mixer and Bidwell low-slump finishing machine to place a ploymer concrete bridge deck overlay has been shown to be workable. Methods of pumping and blending the resin must be improved, however before the process can be considered to be fully developed.

Construction 1979

The delay in finishing the project made it necessary to re-scabble and sandblast the deck.

The week of October 14, 1979 was selected as the target week to complete the deck overlay. All deck preparation work was completed the week before.

All materials and small equipment were taken to the work site ready to go Monday morning. The Daffin Mobile Mixer and Bidwell bridge deck finishing machine arrived on the project late Monday afternoon.

A factory representative of Daffin Mobile Mixer visited the job to inspect the Daffin mixer, resin pumps, electric motors and controls. The pumps were the same positive displacement pumps but the electric motors were direct current with a variable speed converter. The Daffin Mixer was well worn. Several items, the water pump, water lines, aggregate belts, auger blades and rubber mixing trough were in marginal conditon. This was the only machine available. It was decided to try to complete the job with this mixer. A search of the area for alternate small mortar mixers was made, but none were available.

The Daffin mixer was calibrated with both aggregate feeds and the resin pumps. Because of the previous years problem of blending promoted and initiated materials, it was decided to pump with one pump from one barrel of resin. The resin was first drawn from the 55 gallon drums in 5 gallon

quantities, promoted, initiated and then poured into a larger container to be pumped into the mixer.

The first mix was placed on the deck Tuesday afternoon. The mix looked good at the start but as placing progressed it looked dry.

The Bidwell finishing machine was not assembled properly and stopped operations for about 10 minutes. This developed into the first major problem. During the delay, the promoted resin in the larger pump container started to gain heat and flash set. This froze the pump and stopped operations for the day. An area of 20' x 14' had been completed in less than an hour.

Because of the loss of one of the two resin pumps, a change in resin handling was in order for Wednesday. It was decided the resin would be promoted and initiated in five gallon buckets. A check would be made of each bucket before pumping to be sure no heat build up was occurring. Only cool materials would be used. Yesterday's deck overlay was inspected and found to have a very open texture. Three feet of the overlay was removed.

The Daffin Mixer had developed large water leaks that could not be eliminated. The mixer was placed on the lane not being overlaid. This required more shoveling of material into final position. The resin began showing its age and had to be screened before catalyzing and again before pumping.

The overlay was started at 1:15 pm. A chip of resin caught in the pump, but did not freeze it. An additional change was made with resin handling. After five buckets of resin were pumped, the system would be flushed with five gallons of solvent.

This last change caused some texture and mix control problems. There was a variation in resin content. The mixer was a continuous mixer and the interuptions of resin flow caused changes. These were not bad enough to stop the project, but were noticeable and should be corrected in the final process.

The Bidwell finishing machine worked very well in spreading, compacting and finishing the overlay. The variation in mix was noticeable behind the finisher.

The operating condition of the Daffin mixer also contributed to non-uniform mix. The mix chamber output would

vary and surge. There was some segregation in the mixer because of the worn mixer blades and the stretched rubber mix chamber.

The remaining 60' x 40' deck area was covered in 45 minutes. All equipment functioned well.

There were promoted resins available at the end of the bridge deck placement. The finished surface behind the finishing machine varied with some looking very open. The promoted resin was spread over the open areas and covered with sandblasting sand. This improved the appearance of the overlay.

On Thursday, the crew could see the end of this project and were anxious to get the job done. The Daffin mixer had been in the repair shop to try to shut off the water leaks, but this was not possible. All the equipment was lined up on the deck ready to go. The Daffin mixer's hydraulic system gave up. Nothing on the mixer worked. The operator was unable to start the mixer so operations were suspended for the year.

An inventory of materials had to be made. Project costs increased with the intermittent operations, additional funding will be necessary to complete the project. With all the equipment problems, a lot of aggregate was wasted.

The biggest problem is the resin and its times to set. As a resin, it has a very short set time and causes problems if there are any delays in operation. In the mix, it must set fast enough to not delay opening to traffic. A balance must be made between these or another method of catalizing must be developed.

Construction 1980

The equipment for the completion of the overlay was rented from two local contractors. A Bidwell finishing machine was not available, but a Gromaco machine for low slump concrete was rented as a replacement. This machine had been modified by adding a one half inch steel plate to the front and back of the screed. This was done by the owner prior to our work. The extra weight was thought to be an improvement.

Again the Daffin mobil mixer was not in the best of condition. The main feed belt was worn and allowed some materials to fall through onto the deck. The resin pumps

and control of last year were returned in good working order.

The resin pumps and aggregate feed of the Daffin mixer were calibrated on Monday and Tuesday. The Gramco finishing machine was adjusted and checked.

On Wednesday, July 16, all equipment was moved to the bridge deck for the start of the second half of the overlay. The five gallon bucket system of supplying resin to the pumps was utilized.

Once operations started, the overlay went very smoothly. One stop to fill the aggregate bins on the Daffin mixer was required but no other stops were made.

The 1/2" material worked much easier than the 3/4" materials. The resin content did vary because of the five gallon method of resin pumping, but was not enough to stop the operation.

Because of the worn aggregate feed belt, some unbonded areas showed up in the overlay. These were removed and patched with hand mixed materials. These patches are very resin rich and show shrinkage cracks.

The Type B overlay was started the next day. The older half of the bridge deck overlay was sandblasted to prepare the surface.

Resin was promoted in two gallon batches and broomed onto the deck. Sand was applied by use of the sandblaster, but this was too slow and did not provide an even layer of sand. The hand method of placing sand was used next with enough sand added to allow foot travel on the sanded surface. This was an excess of sand and had to be removed, but this was very easy and fast to do.

The older double promoted resin was used as the binder with no problems. Brooming the material to a uniform depth and covering with sand gave a fairly good ride and surface. Two coats of resin and sand were applied. The second Type B treatment required about twice the resin.

Evaluation 1981

The deck has been checked for delamination and cracks. The open side appears rougher than the sealed side but both ride fair. The rich patch areas show some cracking but no

full depth problems. The sawed joints have very good shoulders and show no wear.

The overlay is performing as designed; Type B overlay has improved the looks of the project.

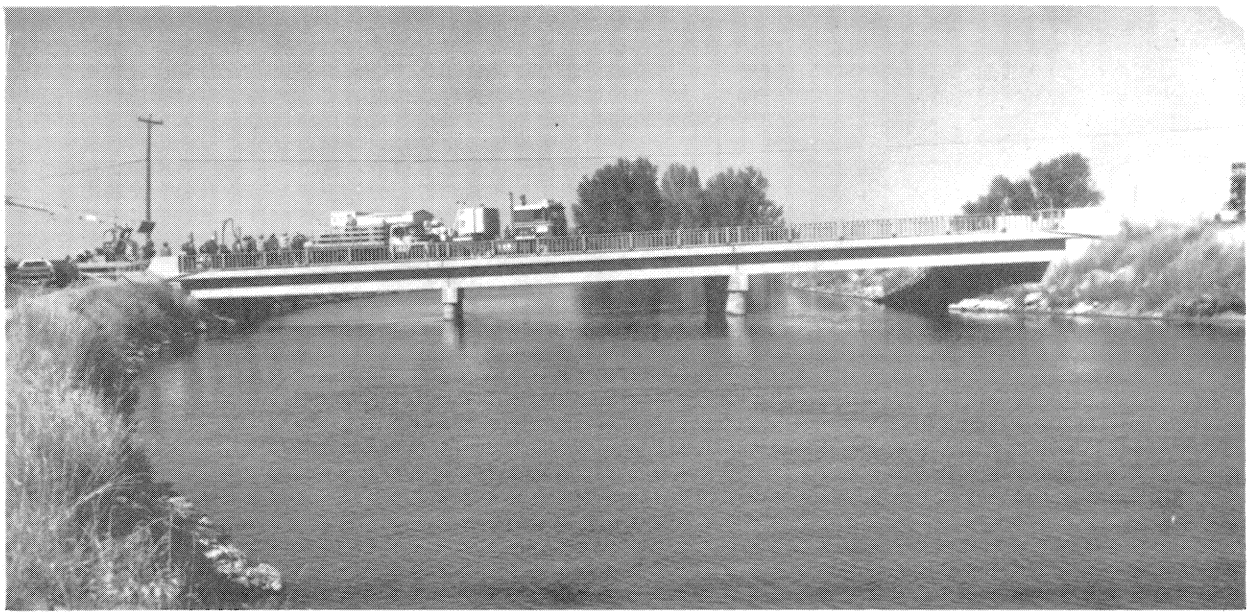
Evaluation 1982

The deck was checked for delamination and cracks. The areas of problems have all grown and show more cracking and delamination. A half cell and resistivity test was attempted, but was not meaningful so it was not completed. The delaminated and cracked areas show very poor results while the good parts show excellent results. The bridge layout record is in Appendix B.

Laboratory tests on core samples taken show water draining through the Type "B" treatment, but the Type "A" material working well.

The delamination and debonding is growing. The areas start near a patch or edge so environmental changes are assumed to be the major cause.

APPENDIX A
Photographs



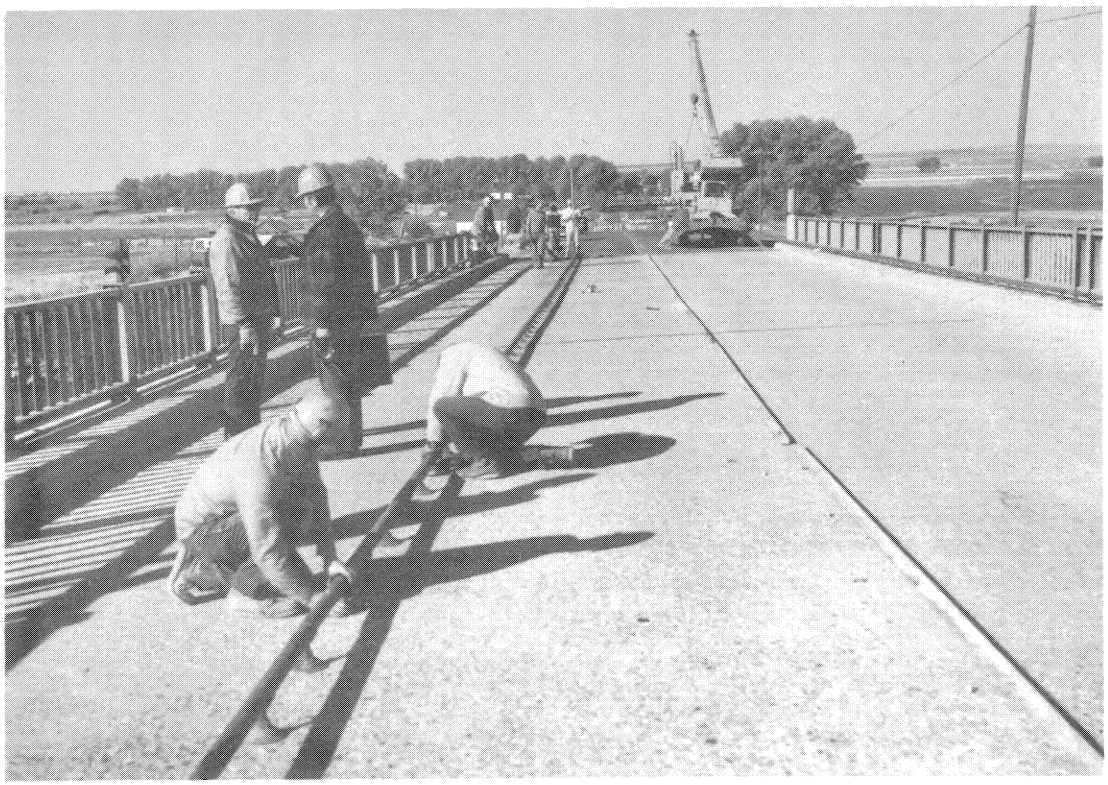
1. The Murtaugh Bridge "day one" placing overlay.

2. Deck prior to any work.

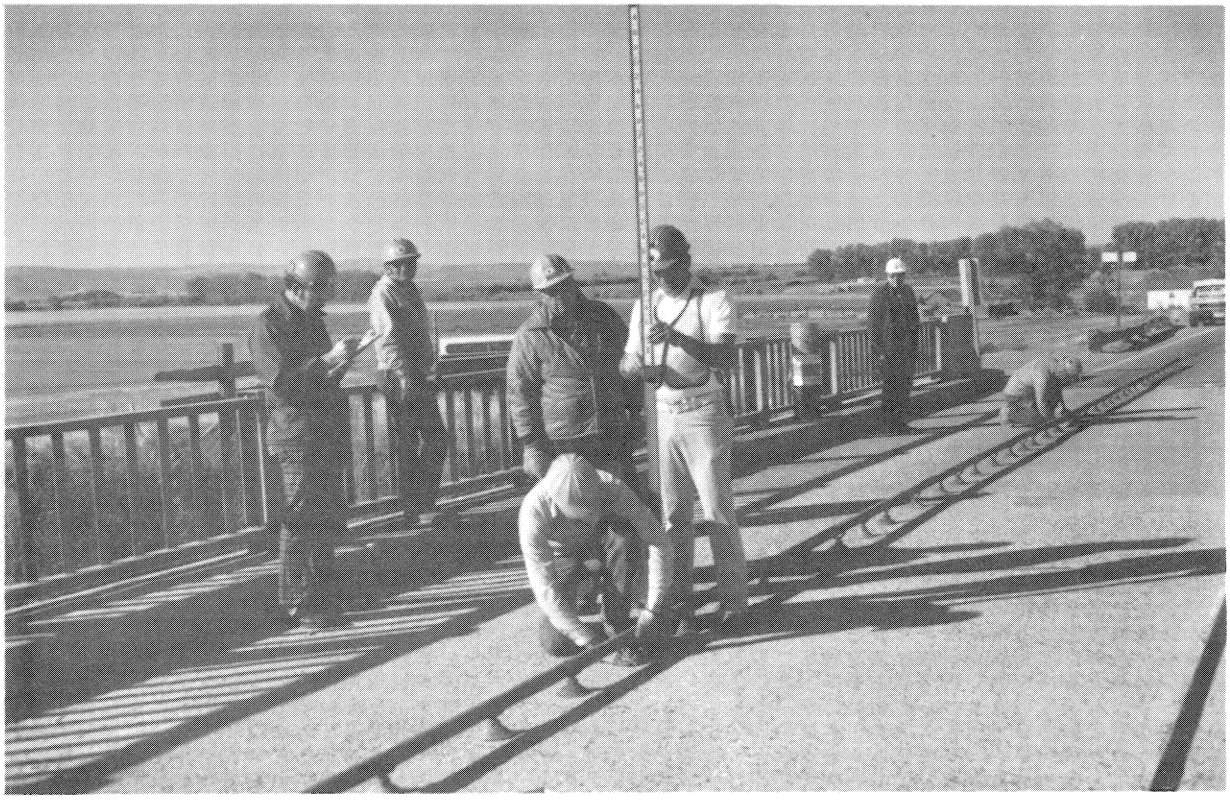
3. Close-up of deck and crack pattern.

4. Measuring promoters.

5. Checking deck temperatures.



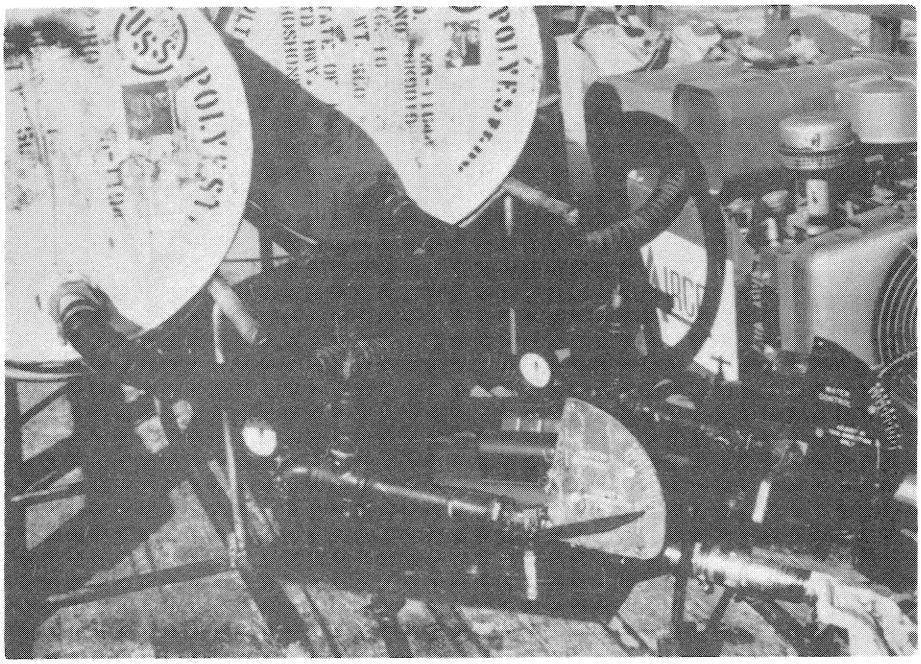
6. Layout of ℄ joint and grade rails.



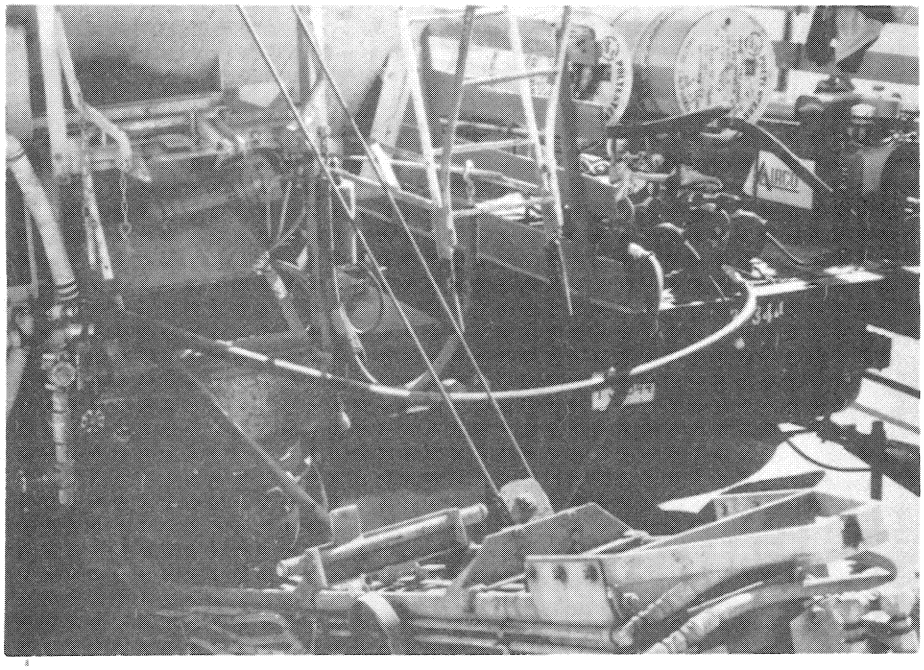
7. Adjusting for proper grade.

8. Finishing machine ready to go.

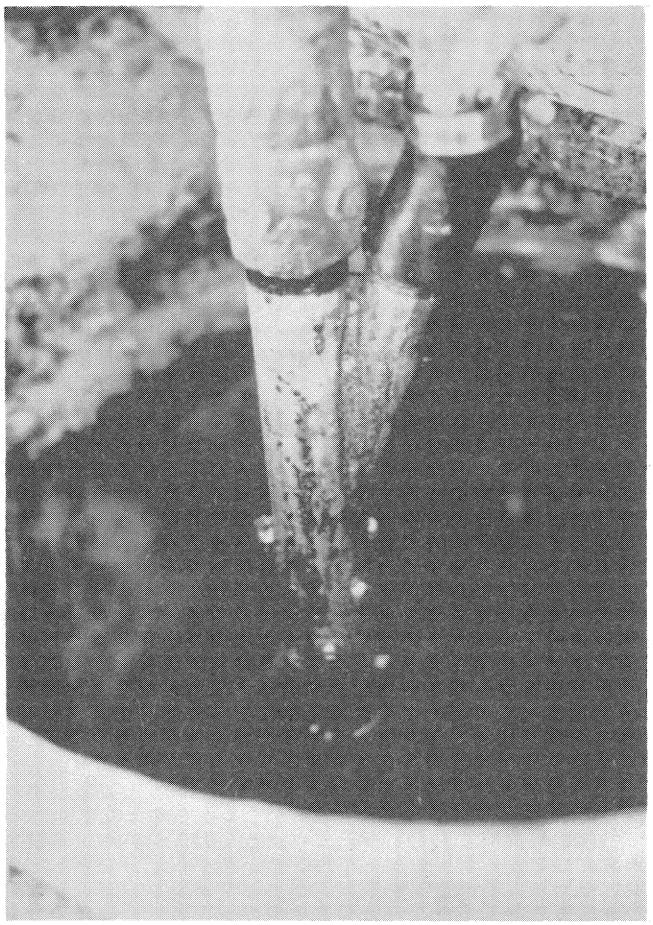
9. Daffin mixer and resin truck ready to move onto bridge.



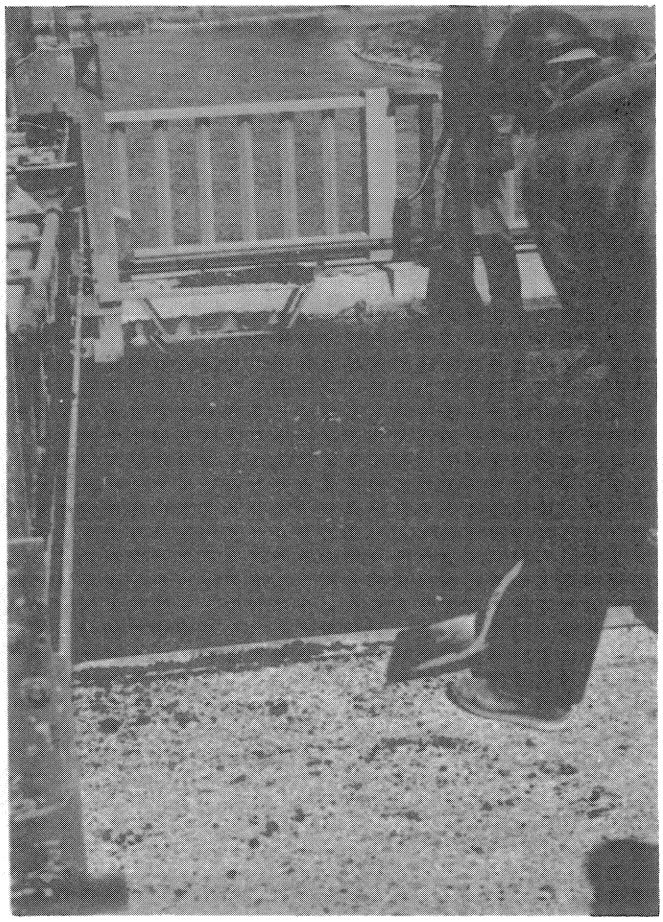
10. Close up of pumps and plumbing.



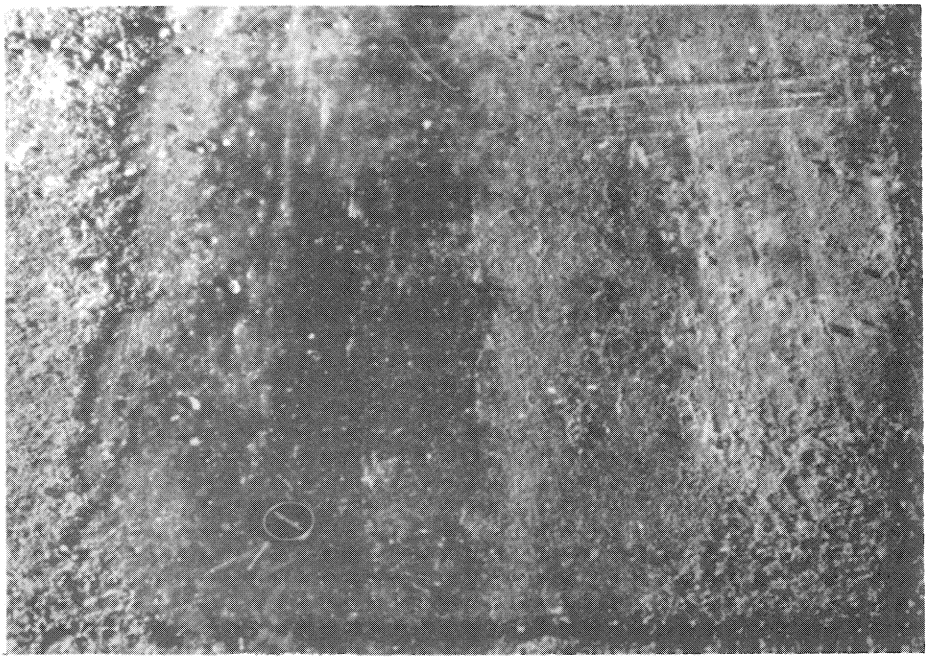
11. Tie between resin truck and Daffin mixer.



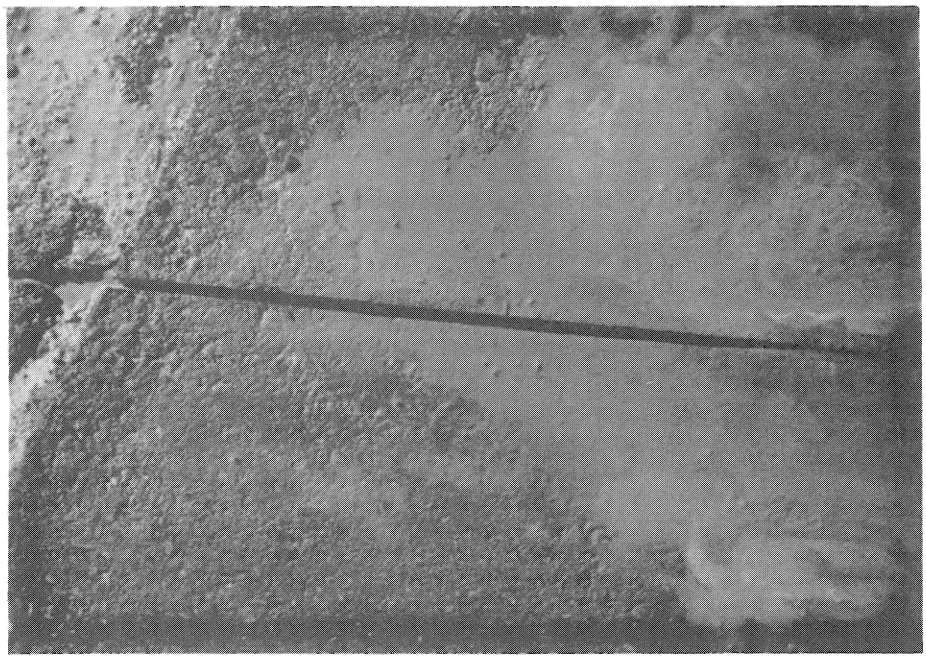
12. Close up of in-line blender 1978.



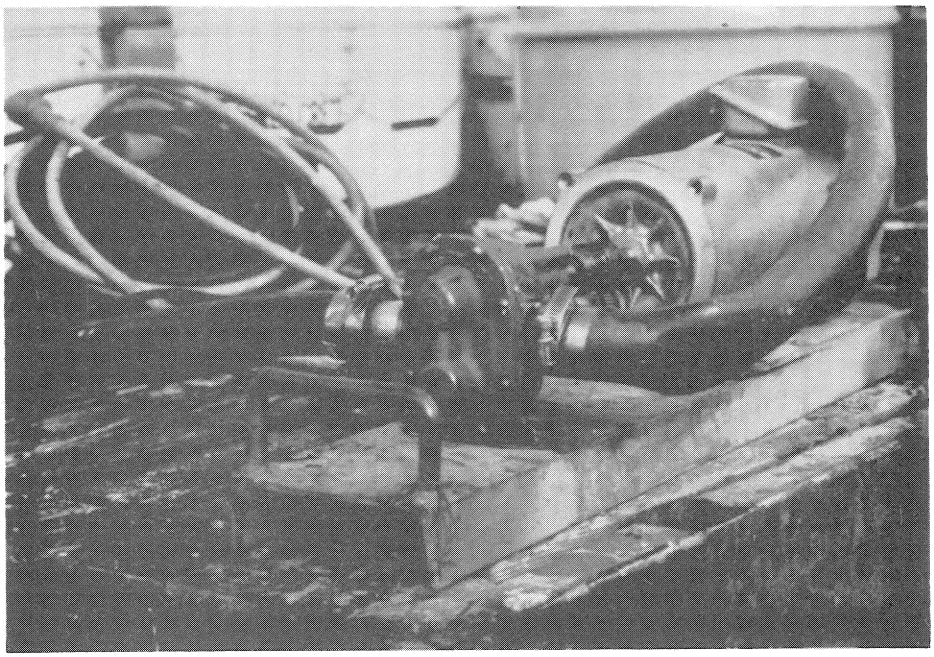
13. Mix in front of the finishing machine 1978.



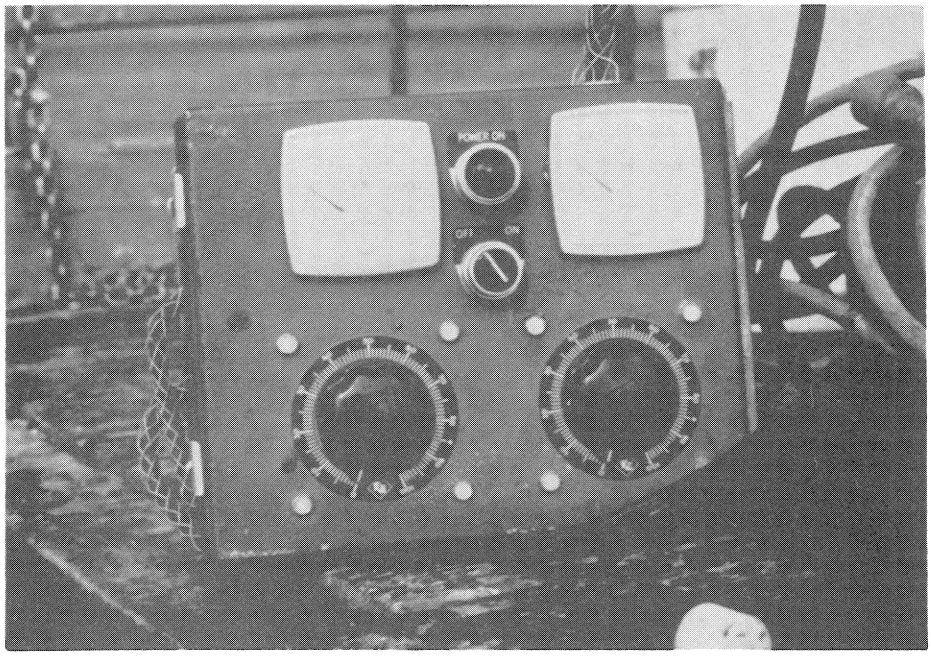
14. Texture of finish material 1978.



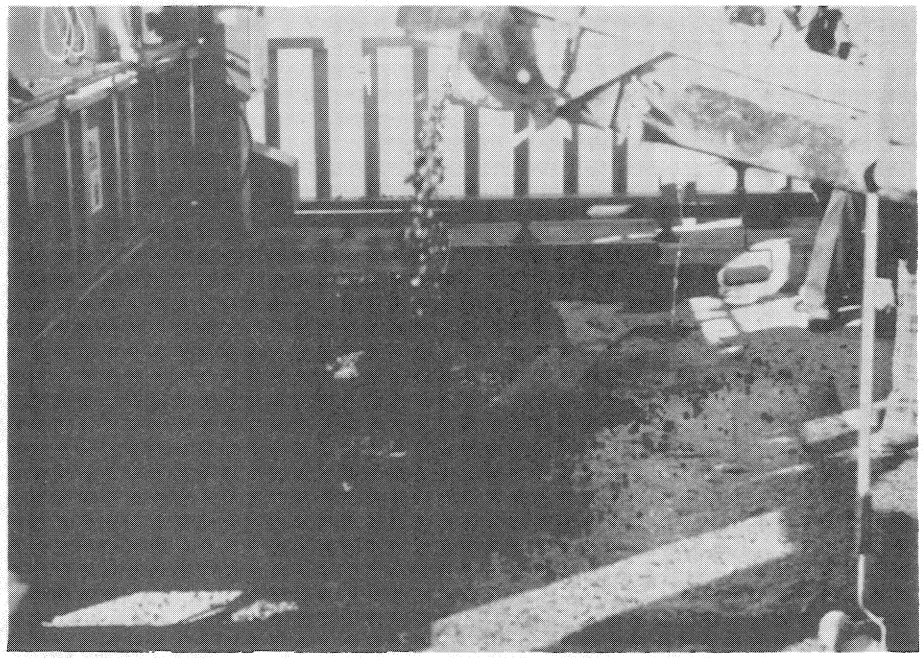
15. Saw joint and center line joint 1978.



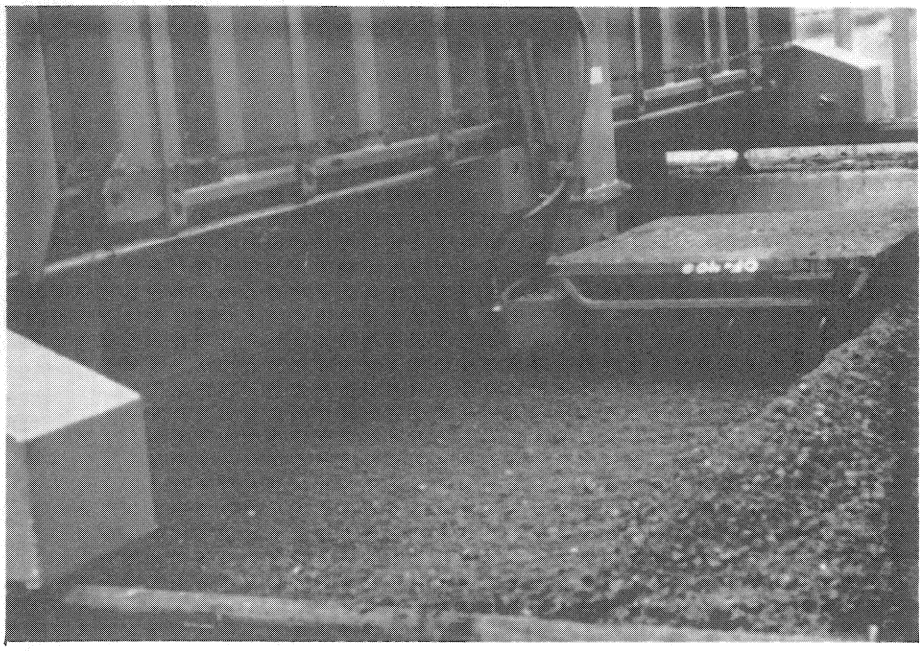
16. Pump ready for 1979.



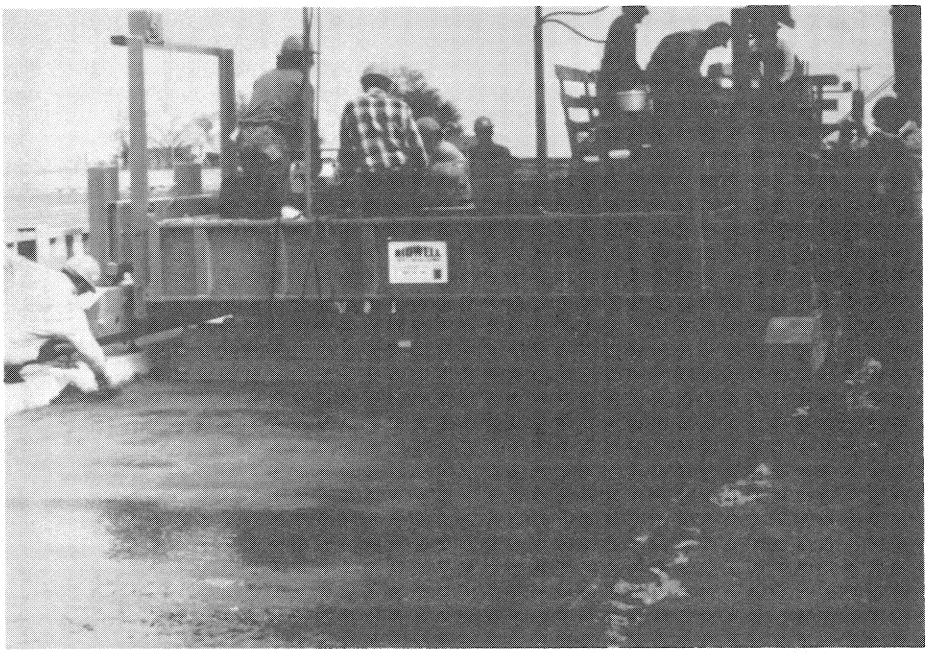
17. Close up of control for pumps 1979.



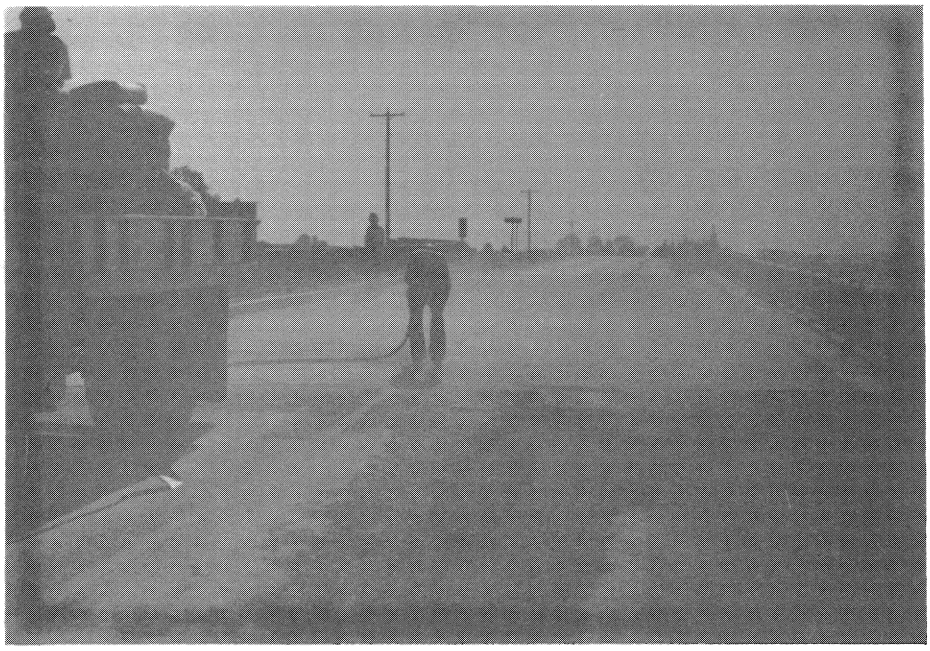
18. Material being placed on deck 1979.



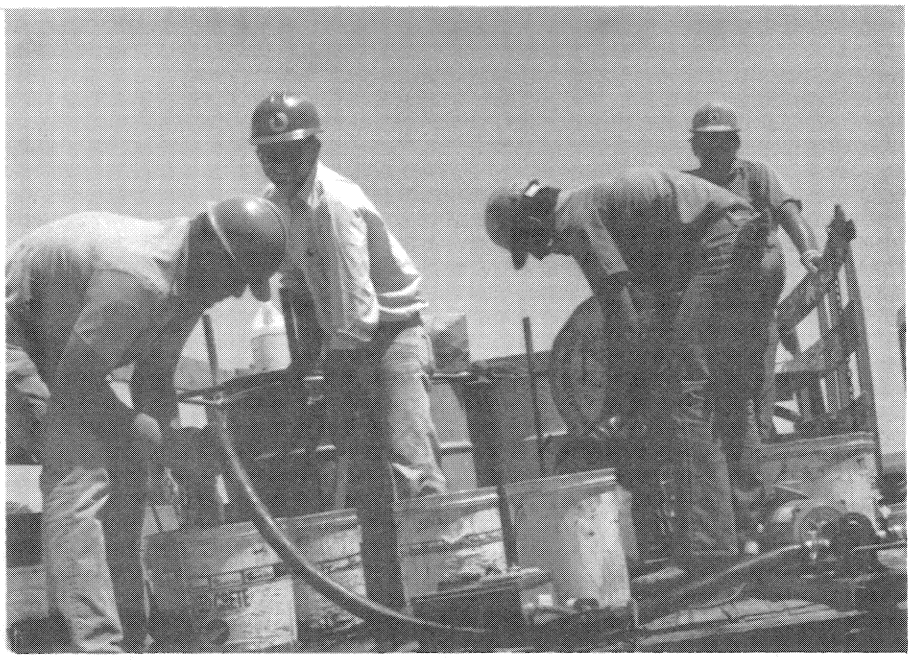
19. In front of finisher 1979.



20. Finished material 1979.

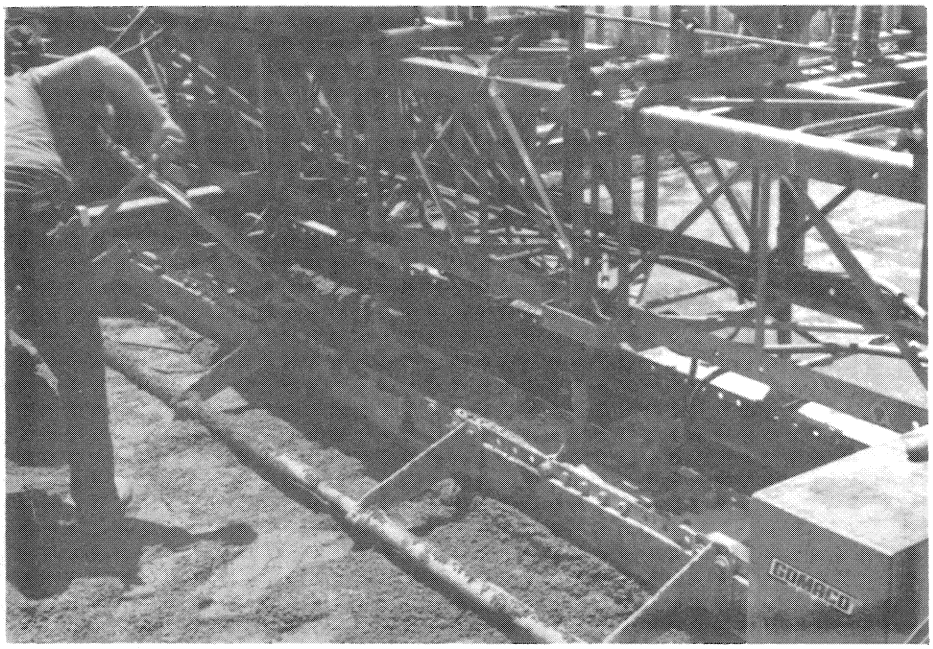


21. Deck preparation 1980.

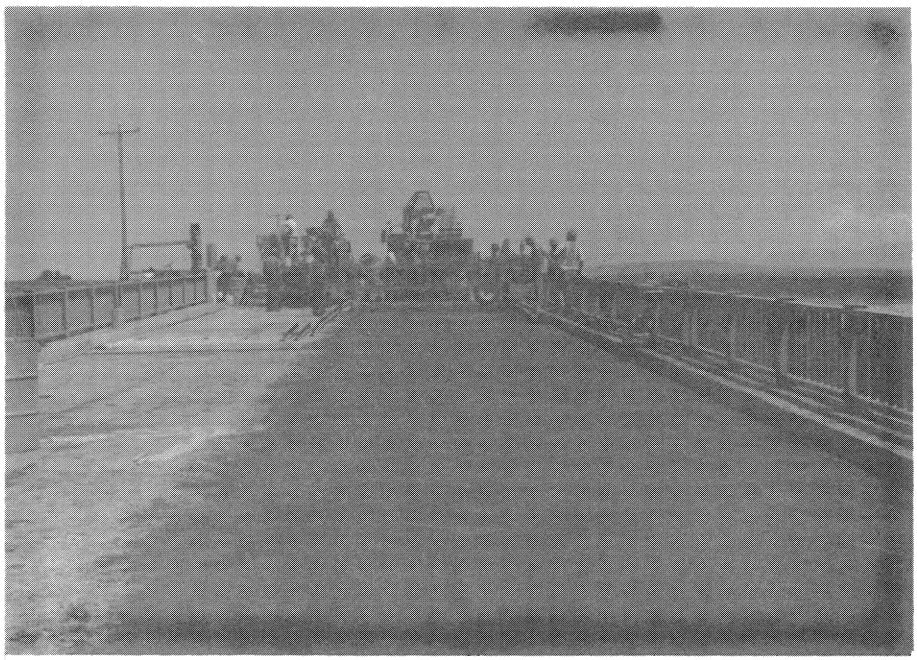


22. Pump truck and crew 1980.

23. Primed deck and new material 1980.



24. Gomaco finishing machine 1980.

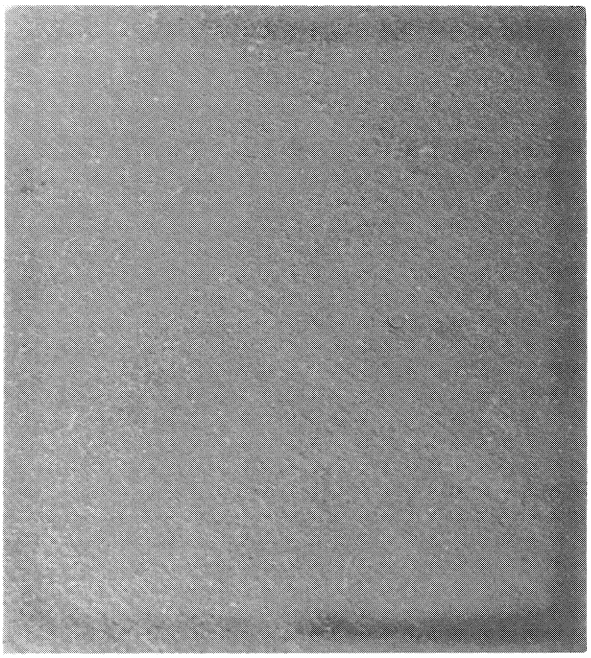


25. Overlay almost completed 1980.

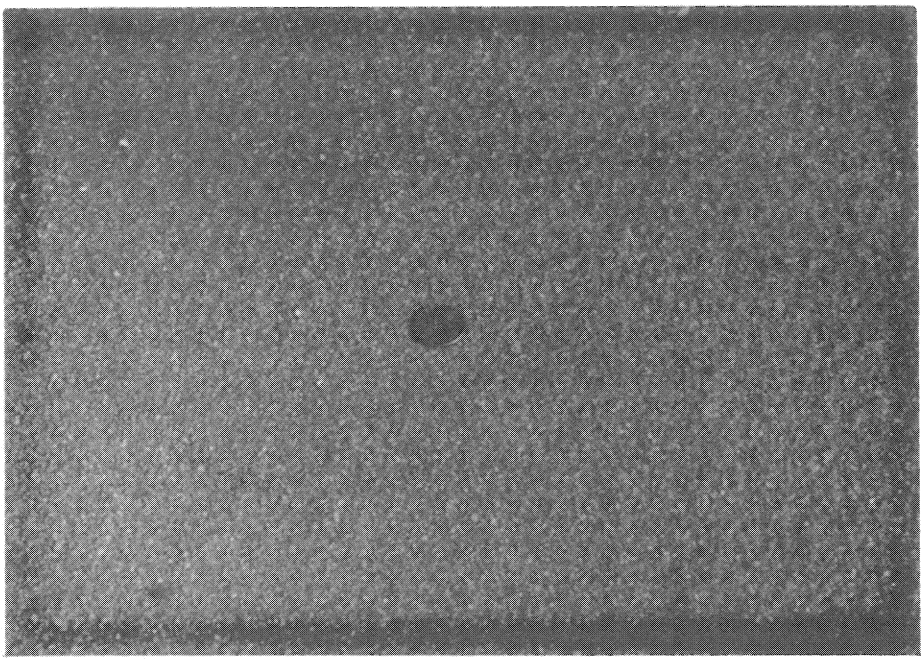
26. Brushing on resin for Type "B" Treatment 1980.

27. Blowing on sand for Type "B" Treatment 1980.

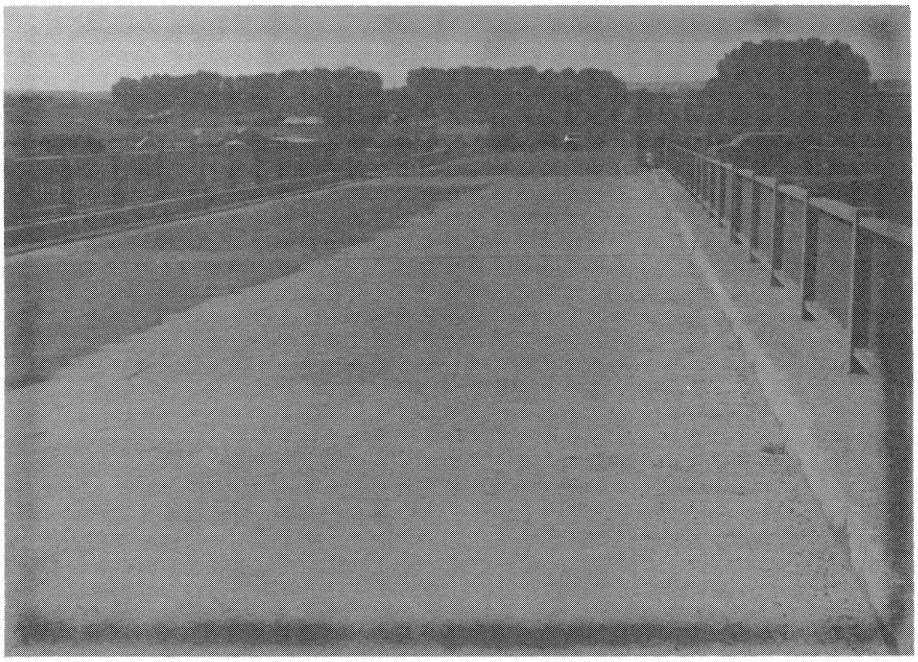
28. Full Type "B" Treatment crew 1980.



29. Close up of overlay finish.



30. Close up of Type "B" finish.



31. Bridge deck after three months Type "B" rt overlay lt

32. Bridge deck after three months.

10

DH-847 4-75

REPORT OF TESTS FOR CHLORIDE IN CONCRETE

LAB No. 78-C-2191

PROJECT Research Project # 96 — COUNTY Twin Falls

IDENTIFICATION No. BG/99097-1313/901-906-CX — DATE SAMPLED 9.13.78

SUBMITTED BY Bill Garrett — QUANTITY REPRESENTED N/A

SAMPLED FROM Main Canal Bridge (Murtaugh) Spans 1-3 — DATE RECEIVED 10.6.78

TESTED FOR Chloride Content

TEST RESULTS

Sample or Core No.	Description and/or Location	Depth In.	Cl lb/cu. yd.
1	Murtaugh Bridge Span #1	1 - 2¼"	0.2
2	" " Span #1	1 - 2"	0.6
3	" " Span #2	1-2"	0.1
4	" " Span #2	½ - 1⅝"	0.3
5	" " Span #3	⅞ - 1⅞"	0.7
6	" " Span #3	½ - 1⅝"	0.1

Remarks:

THIS REPORT COVERS ONLY MATERIAL AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED NOV 14 78

C. B. Humphrey
MATERIALS ENGINEER P.E.

DISTRIBUTION:
CENTRAL FILES
DISTRICT ENGINEER

DH-800 7-78

REPORT OF TESTS ON MATERIAL

SAMPLE OF Polymer Concrete Cores Lab No. 82-C0606

Project Research Project 65. County Ada
Submitted by Jim Hill Date Sampled 5/82
Ident. No. JH/G809030-RS Quantity Represented NA
Sampled from Bridge deck at Murtaugh bridge Date Received 5/26/82
Tested for (Specs.) Chloride penetration

-T-E-S-T- -R-E-S-U-L-T-S-

Three core samples were received for testing for chloride penetration by ponding 5% salt solution. Description of cores as follows:

#1 About 4 inches long X 4 inches diameter. Polymer concrete overlay about 1½ inches over existing concrete— no seal coat

#2 About ½ inch long X 4 inches diameter. Seal coat (sand and resin) that had been applied to material represented by core #1 but became delaminated when core was drilled.

#3 About 2 inches long X 4 inches diameter. Seal coat about 1 inch deep in one area of core.

After salt solution was ponded on the cores the following observations were made:

Core #1 No leakage or seeping of salt solution

Core #2 Salt solutuion dripped through the sample in at least one area and salt deposits seen the next day on the side of the core.

Core #3 Salt solution remained in pond but salt deposits were observed the next day on the entire area of the side where the seal coat had been applied.

CONCLUSIONS:

The seal coat (sand and resin) is not impervious to the salt solution. The polymer concrete overlay will be ponded and tested for chloride penetration in 30 days. The results on this core will be published as additional information.

This report covers only material as represented by the sample submitted and does not necessarily cover all material from this source.

Date Mailed MAY 26 1982

C. B. Humphrey
Materials Supervisor, P.

HT

DH-800 7-78

REPORT OF TESTS ON MATERIAL

ADDITIONAL INFORMATION
ATTACH TO ORIGINAL REPORT

SAMPLE OF Polymer Concrete Cores Lab No. 82-C0606

Project Research Project 65 County Ada
Submitted by Jim Hill Date Sampled 5/82
Ident. No. JH/G809030-RS Quantity Represented N/A
Sampled from Bridge deck at Murtaugh Bridge Date Received 5-26-82
Tested for (Specs.) Chloride penetration by AASHTO T 259-80I

-T-E-S-T- -R-E-S-U-L-T-S-

The chloride content was determined by Idaho T-131-80 after 60 days of ponding with sodium chloride solution. The results were as follows:

¼-3/4 inch depth	0.3 pounds of chloride ion per cubic yard of concr
3/4-1½ inches depth	0.2 " " " " " " " " "

ADDITIONAL INFORMATION
ATTACH TO ORIGINAL REPORT

INFORMATION ONLY

This report covers only material as represented by the sample submitted and does not necessarily cover all material from this source.

Date Mailed AUG 11 1982

Phillip A. Marsh, P.E
Materials Supervisor

Report of: Tests on Concrete Aggregates Proposed to be supplied to the ITD/Highway District II Shoshone, Idaho

Date September 20, 1978
Job Number 68-316
Sheet 1 of 1

Report to: Consolidated Concrete Company
P.O. Box 1597
Boise, Idaho 83701

Sample Identification

On September 18, 1978, your personnel delivered to our laboratory two (2) samples of concrete aggregates reported to be from your facility in Boise, Idaho. At your request, we performed sieve analyses in accordance with ASTM C 136 and calculations to determine blend percentages required to meet the project specifications.

The test results are summarized as follows:

Test Results

Sieve Analysis

Sieve Size	Lab No. 80366 Fine Agg.	Lab No. 80367 Coarse Agg.	PERCENT PASSING Blend of: No. 80366 (47.5%) No. 80367 (47.5%) & Cement (5%)	Project Specs.
1/2"	---	---	100	100
3/8"	---	100	100	86-100
1/4"	---	57	80	71-85
No. 4	100	25	64	---
No. 10	84	3.1	46	40-47
No. 20	63	---	35	---
No. 40	35	---	21	18-23
No. 80	9	---	9	---
No. 100	7	---	8	---
No. 200	2.9	---	6.4	6-8

Certified Richard T. Kaarremaa

DH-800 7-78

REPORT OF TESTS ON MATERIAL

Sheet 1 of 5

SAMPLE OF Premixed Concrete Aggregate & Cement for Polymer Concrete Lab No. 78-S0608

Project Research No. 96 County Twin Falls
Submitted by Jim Hill Date Sampled 10-2-78
Ident. No. JH/99097-1313/201-CX Quantity Represented 75,000 lb.
Sampled from Consolidated Conc. Co. - Boise Ad-86c Date Received 10-5-78
Tested for (Specs.) Polymer Conc. Agg. for Brdg. Deck O'Lay.

-T-E-S-T- -R-E-S-U-L-T-S-

SIEVE ANALYSIS on
5 bag sample @ 2 tests/bag
3 bag blend

Sieve Size	* Ave. Grad. of 10 tests, % Pass	Contract Specs.
½"	100	100
3/8"	100	86 - 100
¼"	92	71 - 85
No.4	83	
No.10	65	40 - 47
No.20	54	
No.30	44	
No.40	33	18 - 23
No.50	22	
No.100	12	
No.200	8.4	6 - 8

These samples will not meet contract specifications.

* These samples contained approximately 5% cement.

INFORMATION ONLY

This report covers only material as represented by the sample submitted and does not necessarily cover all material from this source.

Date Mailed OCT 31 1978

C. B. Humphrey
Materials Supervisor, P.E.

Distribution: ☐ Materials Supervisor ☐ Dist. Matls. Engr. ☐ Resident Engineer

DH-301 4-69

REPORT OF TESTS ON CONCRETE AGGREGATE

LAB. No. 80-02-0241

PROJ. No. Research #96 CONTROL No. #1 DOT COUNTY

IDENT. No. RC/99097-1313/901-cx SUBMITTED BY R. Clayton

NAME OF SOURCE Consolidated Concrete Co., Boise PIT No.

LEGAL LOCATION QUANTITY REPRESENTED 1 90 lb. bag

DATE SAMPLED 6/18/80 ITEM No. DATE RECEIVED 6/19/80

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS OF COARSE AGGREGATE

PER CENT PASSING BY DRY WEIGHT

COURSE AGGREGATE ____ % FINE AGG. ____ %

IDENT. No.				BLEND	SPECS.
SIZE, IN.	SPECS.		SPECS.		SIZE #
3" Sq.*					
2 1/2" Sq.					
2" Sq.					
1 1/2" Sq.*					
1" Sq.					
3/4" Sq.*					
1/2" Sq.					
3/8" Sq.*					
No. 4 *					
No. 8 *					
F. M. *					

	COARSE AGGREGATE		FINE AG
BULK (DRY)			
SP. GR.			
ABSORPTION	%	%	
LB./C.F. DRY LOOSE			
ORGANIC COLOR			
L. A. WEAR, GRADING" "		%	

MORTAR STRENGTH OF FINE AGGREGATE

AVERAGE 3 CYLINDERS, 2" DIA. 4" HEIGHT

COMPRESSIVE STRENGTH, PSI

TYPE CEMENT

AGE AT TEST	OTTAWA SAND	ORIGINAL SAMPLE	STR. RATI
____ DAY			
____ DAY			

MECHANICAL ANALYSIS OF FINE AGGREGATE

IDENT NO.	Dry	Washed	BLEND	SPECS.
3/8" Sq. *				
No. 4 *	71	73		
No. 8 *	60	63		
No. 16 *	46	49		
No. 30 *	31	33		
No. 50 *	16	18		
No. 100 *	9	10		
No. 200	6.1	7.3		8-6
F.M. *				
SAND EQU.				70 MIN.

CLASSIFICATION:

REMARKS:

Gradation Only

*ATTN: Jim Hill

MATERIAL AS REPRESENTED IS 2 bag blend

THIS REPORT COVERS ONLY MATERIAL AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED 6/20/80

R.K. Sorensen
MATERIALS ENGINEER

DISTRIBUTION: ☐ CENTRAL FILES ☐ DIST. ENGR. ☐ RES. ENGR. ☐ FED. HWY. ADMIN.

DH-845 1-78

REPORT OF TESTS ON CONCRETE CYLINDERS

LAB. No. 79-S0273

PROJECT No. Research No. 96 COUNTY Twin Falls

SUBMITTED BY Jim Hill

DATE OF POUR 10-16-79 SLUMP, IN. _____ WT./C.F.(FRESH CONC.) _____

QUANTITY POURED, C.Y. _____ AIR, % _____ CRSE.AGG.SIZE No. _____

AGE AT TESTING, DAYS 6 CLASS Polymer Concrete CONTRACT ITEM No. _____

STATION (s) _____ PORTION OF STRUCTURE Deck Placement

DATE RECEIVED 10-22-79 SOURCE, NAME & No. W.R. Grace Co.

DATE OF TEST (s) 10-22-79

-T-E-S-T- -R-E-S-U-L-T-S-

IDENT No. JWH/99097-1313/1002-CX	A	B	C	D
SIZE: DIAMETER, IN.	3.00	3.00	3.00	3.00
HEIGHT, IN.	6.10	6.20	6.20	6.10
UNIT WEIGHT, LB./CU.FT.	N/A	N/A	N/A	N/A
DEFECTS: ENDS	←	Very Rough		→
OTHER				
TYPE OF FRACTURE: CONICAL	✓	✓	✓	✓
OTHER				
TYPE OF FAILURE: BOND				
BOND & SOME AGGREGATE	✓	✓	✓	✓
BOND & AGGREGATE				
COMPRESSIVE STRENGTH, PSI	4683	4,499	5,475	5,277

AVERAGE COMPRESSIVE STRENGTH, PSI 4984

AVERAGE OF LAST 5 CONSECUTIVE TESTS, PSI N/A INTENDED STRENGTH ---------- PS

REMARKS _____

INFORMATION ONLY

THIS REPORT COVERS ONLY MATERIALS AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED OCT 22 1979

C. B. Humphrey P.E.

DISTRIBUTION: ☐ MATLS. SUPVR. ☐ DIST. MATLS. ENGR. ☐ RES. ENGR.

DH-845 1-78

Sheet 1 of 2.

REPORT OF TESTS ON CONCRETE CYLINDERS

LAB. No. 79-80268

PROJECT No. Research Project 96 COUNTY Twin Falls

SUBMITTED BY Gary Th ompson

DATE OF POUR 10-11-79 SLUMP, IN. N/A WT./C.F.(FRESH CONC.) ?

QUANTITY POURED, C.Y. AIR, % N/A CRSE.AGG.SIZE No. 3/4

AGE AT TESTING, DAYS 1 day CLASS Polymer Concrete CONTRACT ITEM No.

STATION (s) PORTION OF STRUCTURE Sampled from test batch

DATE RECEIVED 10-12-79 SOURCE, NAME & No. W. R. GRACE Co.

DATE OF TEST (s) 10-12-79

-T-E-S-T- -R-E-S-U-L-T-S-

IDENT No. GVT/99097-1313/1001 CX	A	B	C
SIZE: DIAMETER, IN.	3.00	3.01	3.00
HEIGHT, IN.	6.36	6.30	6.36
UNIT WEIGHT, LB./CU.FT.	N/A	N/A	N/A
DEFECTS: ENDS	Good	Good	Good
OTHER			
TYPE OF FRACTURE: CONICAL			
OTHER			
TYPE OF FAILURE: BOND			
BOND & SOME AGGREGATE			
BOND & AGGREGATE			
COMPRESSIVE STRENGTH, PSI	5,050	5,030	4,730
AVERAGE COMPRESSIVE STRENGTH, PSI			
AVERAGE OF LAST 5 CONSECUTIVE TESTS, PSI		INTENDED STRENGTH	PS

REMARKS Cyl. "A" = 2.0% MEKP - Double Promoted, Cyl. "B" = 1.5% MEKP, Cyl. "C" = 1.25% ME

INFORMATION ONLY

THIS REPORT COVERS ONLY MATERIALS AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED OCT 22 1979

C. B. Humphrey P.E.

DISTRIBUTION: ☐ MATLS. SUPVR. ☐ DIST. MATLS. ENGR. ☐ RES. ENGR.

DH-845 1-78

REPORT OF TESTS ON CONCRETE CYLINDERS

Sheet 2 of 2.

LAB. No. 79-S0268

PROJECT No. Rearch Project 96 COUNTY Twin Falls

SUBMITTED BY Gary Thompson

DATE OF POUR 10-11-79 SLUMP, IN. N/A WT./C.F.(FRESH CONC.) ?

QUANTITY POURED, C.Y. _____ AIR, % N/A CRSE.AGG.SIZE No. 3/4

AGE AT TESTING, DAYS 1 day CLASS Polymer Concrete CONTRACT ITEM No. _____

STATION (s) _____ PORTION OF STRUCTURE Sampled from test batch

DATE RECEIVED 10-12-79 SOURCE, NAME & No. W.R. GRACE Co.

DATE OF TEST (s) 10-12-79

-T-E-S-T- -R-E-S-U-L-T-S-

IDENT No. GVT/99097-1313/1001-CX	D	E	
SIZE: DIAMETER, IN.	3.00	3.02	
HEIGHT, IN.	6.36	6.40	
UNIT WEIGHT, LB./CU.FT.	N/A	N/A	
DEFECTS: ENDS	Good	Good	
OTHER			
TYPE OF FRACTURE: CONICAL			
OTHER			
TYPE OF FAILURE: BOND			
BOND & SOME AGGREGATE			
BOND & AGGREGATE			
COMPRESSIVE STRENGTH, PSI	5,180	4,400	
AVERAGE COMPRESSIVE STRENGTH, PSI			
AVERAGE OF LAST 5 CONSECUTIVE TESTS, PSI			

INTENDED STRENGTH _____ PS

REMARKS Cyl. "D" = 2.0% MEKP, Cyl. "E" = 1.5% MEKP Double Promoted.

INFORMATION ONLY

THIS REPORT COVERS ONLY MATERIALS AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED OCT 22 1979

C. B. Humphrey P.E.

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DH-800 7-78 4

REPORT OF TESTS ON MATERIAL

SAMPLE OF Polymer Concrete Lab No. 79-C-2078

Project Research Project 96 County Twin Falls
Submitted by Jim Hill Date Sampled 10.16.79
Ident. No. JH/99097-1313/901-CX Quantity Represented N/A
Sampled from Deck Placement Date Received 10.30.79
Tested for (Specs.) Resin content

-T-E-S-T- -R-E-S-U-L-T-S-

Cylinder A

Weight of material	105.81 grams
Weight of resin	9.25 grams
Percent resin	8.7 percent

Cylinder D

Weight of material	126.16 grams
Weight of resin	11.09 grams
Percent resin	8.8 percent

INFORMATION ONLY

This report covers only material as represented by the sample submitted and does not necessarily cover all material from this source.

Date Mailed NOV 21 1979

C.B. Humphrey, P.E
Materials Supervisor

bnt

DH-848 3-75

BRIDGE DECK SURVEY

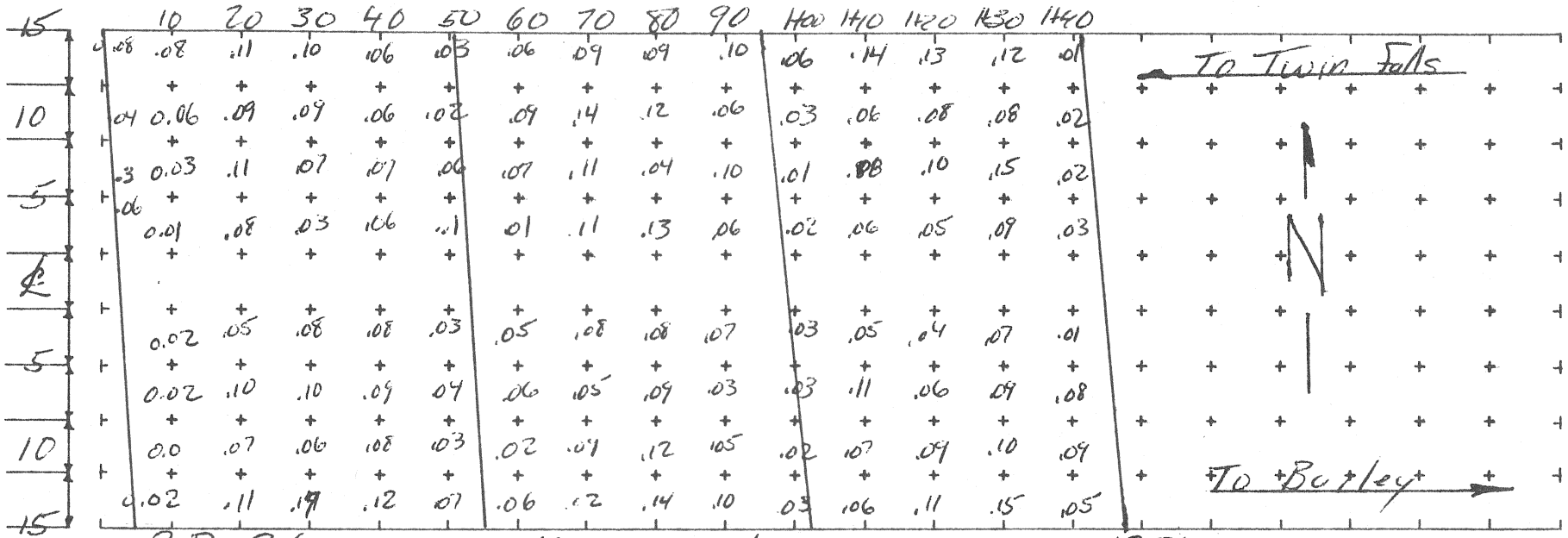
~~Resistance~~/Voltage

TEST DATA BY: Bill Garrett

DISTRICT 4

DATE 11-25-79

PAGE 1 OF 1



PROJECT NO. R.P. 96 LOCATION Main Canal DATE CONSTRUCTED 1956 DATE OVERLAYED

NO. OF SPANS 3 SPAN LENGTH TYPE OF CROSSING Water-Way

DATA UNITS IN: ~~Ohms~~/VOLTS WEATHER Cloudy, Windy, cool LANE 2

REMARKS:

NOTE: (1) INDICATE NORTH ARROW AT RIGHT SIDE OF PAGE.

(2) SHOW LANE MARKINGS, JOINTS, TRAFFIC BARRIERS, DIRECTION OF TRAFFIC FLOW, CURBS, SURFACE CRACKING, WEAR, SPALLING

(3) SHOW GRID DIMENSIONS ON LEFT SIDE OF PAGE AND ACROSS TOP (NORMALLY 5 FT.).

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DH-848 3-75

BRIDGE DECK SURVEY

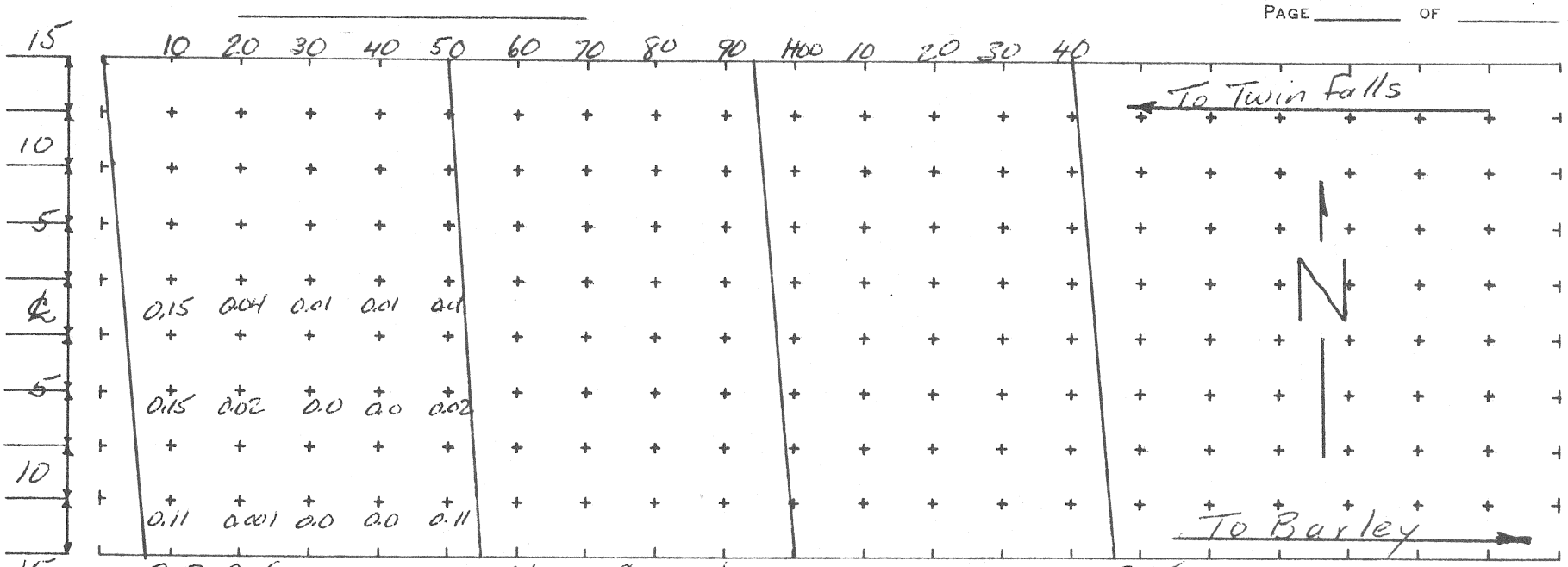
~~Resistance~~/Voltage

TEST DATA BY: Bill Garrett

DISTRICT 4

DATE 5-18-82

PAGE _____ OF _____



PROJECT NO. R.P 96 LOCATION Main Canal DATE CONSTRUCTED 1956 DATE OVERLAYED 1981

NO. OF SPANS 3 SPAN LENGTH 46' TYPE OF CROSSING water-way

DATA UNITS IN: ~~OHMS~~/VOLTS _____ WEATHER Cold windy LANE 2

REMARKS: _____

NOTE: (1) INDICATE NORTH ARROW AT RIGHT SIDE OF PAGE.
(2) SHOW LANE MARKINGS, JOINTS, TRAFFIC BARRIERS, DIRECTION OF TRAFFIC FLOW, CURBS, SURFACE CRACKING, WEAR, SPALLING
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BRIDGE DECK SURVEY

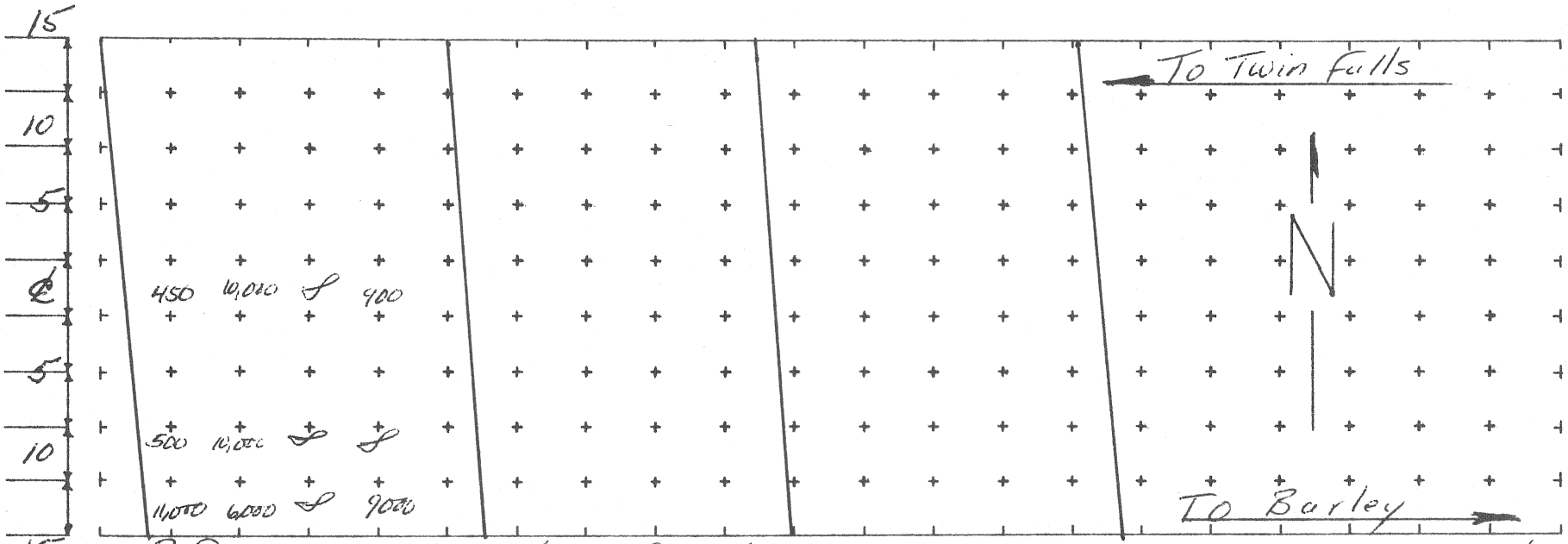
Resistance/~~Voltage~~

TEST DATA BY: Bill Garrett

DISTRICT 4

DATE 5-18-82

PAGE _____ OF _____



PROJECT NO. R.P. 96 LOCATION Main Canal DATE CONSTRUCTED 1956 DATE OVERLAYED 1981

NO. OF SPANS 3 SPAN LENGTH 46 TYPE OF CROSSING water-way

DATA UNITS IN: OHMS/~~VOLTS~~ WEATHER Cold windy LANE 2

REMARKS: Readings very greatly not a good Test

NOTE: (1) INDICATE NORTH ARROW AT RIGHT SIDE OF PAGE.
(2) SHOW LANE MARKINGS, JOINTS, TRAFFIC BARRIERS, DIRECTION OF TRAFFIC FLOW, CURBS, SURFACE CRACKING, WEAR, SPALLING
(3) SHOW GRID DIMENSIONS ON LEFT SIDE OF PAGE AND ACROSS TOP (NORMALLY 5 FT.).

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DH-848 3-75

BRIDGE DECK SURVEY

Resistance/Voltage

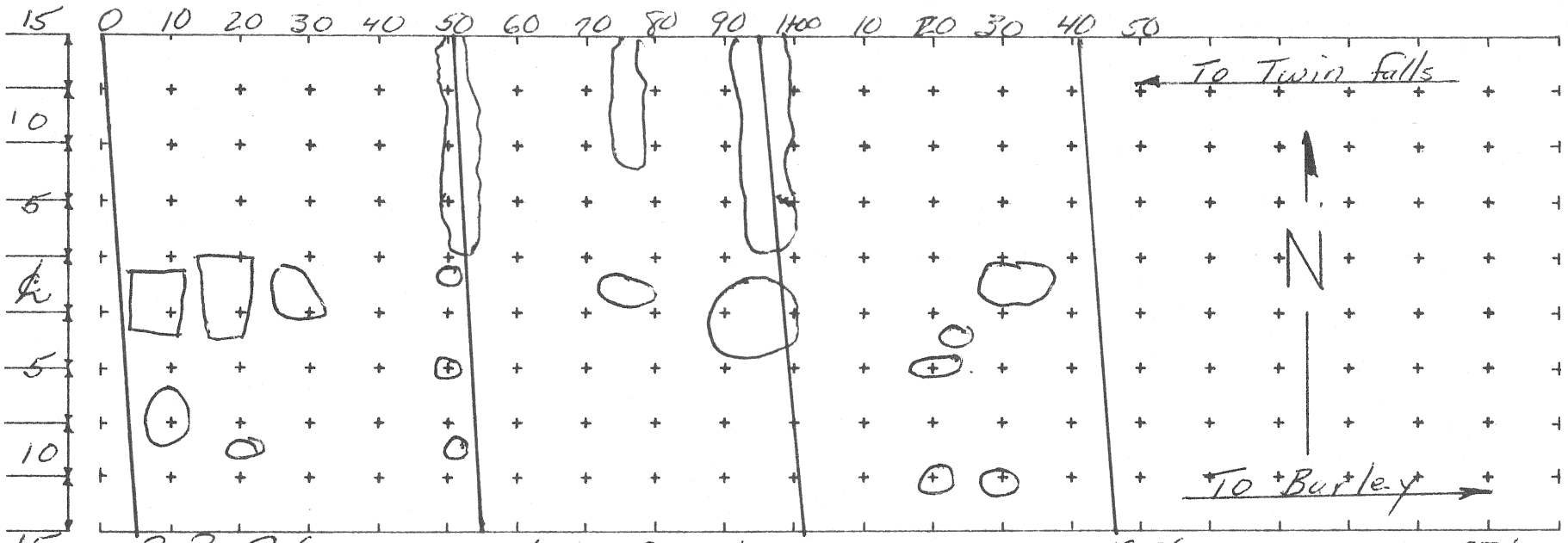
Chain Drag

TEST DATA BY: Bill Garrett

DISTRICT 4

DATE 5-18-82

PAGE 1 OF 1



PROJECT NO. R.P. 96 LOCATION Main Canal DATE CONSTRUCTED 1956 DATE OVERLAYED 1981

NO. OF SPANS 3 SPAN LENGTH 46' TYPE OF CROSSING water-way

DATA UNITS IN: OHMS/VOLTS WEATHER Cold windy LANE 2

REMARKS: □ & ○ show delaminated areas

NOTE: (1) INDICATE NORTH ARROW AT RIGHT SIDE OF PAGE.

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(3) SHOW GRID DIMENSIONS ON LEFT SIDE OF PAGE AND ACROSS TOP (NORMALLY 5 FT.).

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Appendix C
Cost Breakdown

RESEARCH PROJECT #96

MATERIALS AND SUPPLIES PURCHASED IN 1978 - 1980

YEAR	ITEM	AMOUNT
1978	Concrete Aggregate	$ 1936.08
	Chemicals	3737.62
1979	Concrete Aggregate	$ 1119.40
	Chemicals	1960.02
1980	Concrete Aggregate	$ 1200.00
	Chemicals	1564.00
	TOTAL	$11517.12

RECAP - Authority 99097

	Salaries 001-2-3-4-5-6	State Car Rental 101	Other Equip. Rental 102	Equip. Rental not State Owned 105	Equip. Rental Other Than Road & Office 106	Public Convey. Training Meetings 111	Subsis-tance 201	Auto Park Fees 205	Subsis-tance Train Meeting 214	Matls. Testing Equip. Rental 401	Lab Tests 406	Mat'ls. & Supply 501	Tel.& Telgr. 601	Reg. Fee 612	Freight 919
Aug. '78	124.68	10.64													
Sept. '78	410.68	98.84	54.00												
Oct. '78	9,282.69	345.24	1,853.40				560.96				297.60	386.07	1.25		
Nov. '78	394.36						30.48				2,376.15	987.62			
Dec. '78												176.45			
Jan. '79												5,673.04			
Feb. '79	116.46				4,112.65					51.00					
Mar. '79	105.87				22.37										
Apr. '79											209.25				
May '79												1,959.90			
June '79												43.12			
July '79						15.00		10.00	123.60					25.00	
Aug. '79						116.00						1,119.40			
Oct. '79	7,561.05	249.20	3,708.80				480.80					619.43	2.50		
Nov. '79	103.80			4,374.00	75.00						1,357.80	1,151.46			
Dec. '79	32.00			160.00									7.72		
Mar. '80				1,476.00							55.80				
June '80	361.48	30.38					53.98					2,815.00			
July '80	9,464.97	280.60	2,640.05		1,112.50		396.94				148.80	832.50	6.68		
Aug. '80	53.19				81.00		408.00				595.20	22.69	3.53		65.15
Sept. '80				4,020.00								113.93			
Oct. '80	187.32	35.65	280.00												
Jan. '81												11.63			
TOTAL	28,198.55	1,050.55	8,536.25	10,030.00	5,403.52	131.00	1,931.16	10.00	123.60	51.00	5,040.60	15,912.26	21.68	25.00	65.15